UNIVERSITI PUTRA MALAYSIA

EFFECTS OF LYCOPENE AND RED PALM OIL ON OXIDATIVE STRESS IN STREPTOZOTOCIN-INDUCED DIABETIC RATS

HANIEH JAFARI

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MASTER OF SCIENCE

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2010

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By

HANIEH JAFARI

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in

Fulfilment of the Requirements for the Degree of Master of Science

December 2010

DEDICATION

This thesis is dedicated to
My lovely husband and parents who supported me
all these years

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

EFFECTS OF LYCOPENE AND RED PALM OIL ON OXIDATIVE STRESS IN STREPTOZOTOCIN-INDUCED DIABETIC RATS

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December 2010

Chairman: Professor Asmah Rahmat, PhD

Faculty: Medicine and Health Sciences

The purpose of the current study was to determine lycopene and red palm oil effects on oxidative stress in streptozotocin-induced diabetic rats. The studied parameters for oxidative stress are fasting blood glucose level, oxidative stress biomarkers (superoxide dismutase and glutathion peroxidase), lipid profiles (low-density lipoprotein cholesterol, triglycerides, total cholesterol and high-density lipoprotein cholesterol) and body weight. For induction of diabetes, the rats were injected with 55 mg/kg body weight of STZ (Streptozotocin) dissolved in 0.05 M citrate buffer (pH4.5). Lycopene (10 and 20 mg/kg bw) and red palm oil (10 and 20 mg/kg bw) were given to the diabetic rats by force feeding fo six weeks supplementation. The results indicated that there was significant difference in fasting blood glucose level after 6 weeks of lycopene (10 and 20 mg/kg

bw) and red palm oil (10 and 20 mg/kg bw) administration as compared to diabetic control group. The supplementation with red palm oil (10 and 20 mg/kg bw) significantly ($p < 0.05$) reduced the plasma low-density lipoprotein cholesterol, triglycerides and total cholesterol of diabetic rats as compared to control diabetic (un-treated and super olein oil) animals. The administration with red palm oil 10 and 20 mg/kg bw, has increased the level of HDL-C in treated groups as compared to control diabetic rats. However, there were no significant changes in lipid profiles (low-density lipoprotein cholesterol, triglycerides, total cholesterol and high-density lipoprotein cholesterol) level in diabetic treated groups with lycopene (10 and 20 mg/kg bw) after six weeks supplementation. Superoxide dismutase and glutathion peroxidase activities were enhanced in diabetic treated groups with lycopene (10 and 20 mg/kg bw) and red palm oil (10 and 20 mg/kg bw) compared to that in control diabetic rats. The supplementation of lycopene (10 and 20 mg/kg bw) and red palm oil (10 and 20 mg/kg bw) significantly prevented body weight loss starting from 3rd week of lycopene and red palm oil administration in treated animals. These findings suggest that lycopene may have considerable therapeutic potential as an antioxidant but there was no significant lipid lowering effect in Type 2 diabetes mellitus.

These results also showed that red palm oil (RPO) lowered the blood glucose level and improved dyslipidemia. Level of oxidative stress markers were also reduced with administration of RPO. These findings indicate antidiabetic capability of red palm oil.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN LIKOPEN DAN MINYAK KELAPA SAWIT KE ATAS STRES OKSIDATIF PADA TIKUS TERARUH STREPTOZOTOCIN

Oleh

HANIEH JAFARI

December 2010

Pengerusi: Profesor Asmah Rahmat, PhD

Fakulti: Perubatan dan Sains Kesihatan

Tujuan kajian ini adalah untuk menentukan kesan likopen dan minyak kelapa sawit ke atas stres oksidatif pada tikus teraruh steptozotocin. Parameter yang dikaji dalam kajian ini adalah paras gula dalam darah, enzim stres oksidatif (superoxide dismutase dan glutathion peroksida), profil lipid (jumlah kolesterol, trigliserida, HDL-kolesterol, LDL-kolesterol) dan berat badan. Bagi pengaruhan diabetes ke atas tikus, 55 mg/ kg berat badan streptozotocin (STZ) telah dilarutkan dalam 0.05 M bufer citrate (pH4.5) dan disuntik pada tikus. Likopen (10 and 20 mg/kg berat badan) dan minyak kelapa sawit (10 and 20 mg/kg berat badan) diberikan pada tikus diabetes teraruh streptozotocin secara paksa selama 6 minggu rawatan suplemen.

Hasil kajian menunjukkan terdapat perbezaan yang signifikan dalam paras gula dalam

darah tikus teraruh diabetes selepas 6 minggu pengambilan likopen dan minyak kelapa sawit bagi kedua-dua dos apabila dibandingkan dengan kumpulan kawalan. Rawatan suplemen dengan minyak kelapa sawit (10 and 20 mg/kg berat badan) menurunkan dengan signifikan ($p<0.05$) plasma LDL-kolesterol, trigliserida dan jumlah kolesterol tikus teraruh diabetes apabila dibandingkan dengan kumpulan kawalan diabetes. Pengambilan minyak kelapa sawit (10 and 20 mg/kg berat badan) meningkatkan paras HDL-kolesterol dalam kumpulan rawatan suplemen jika dibandingkan dengan kumpulan kawalan diabetes. Walaubagaimanapun, tiada perubahan yang signifikan dalam profil lipid (jumlah kolesterol, trigliserida, HDL-kolesterol, LDL-kolesterol) tikus yang diberikan suplemen likopen (10 and 20 mg/kg berat badan) selepas 6 minggu tempoh rawatan suplemen. Aktiviti superoxide dismutase dan glutathion peroksida adalah lebih baik dalam kumpulan diabetes yang diberi suplemen likopen dan minyak kelapa sawit pada kedua-dua dos apabila dibandingkan dengan kumpulan kawalan diabetes. Pengambilan suplemen likopen dan minyak kelapa sawit pada kedua-dua dos secara signifikan menghalang penurunan berat badan bermula pada minggu ketiga rawatan suplemen.

Hasil kajian ini menunjukkan bahawa likopen berupaya memberikan potensi teraputik sebagai antioksidan tetapi tiada kesan penurunan lipid yang signifikan terhadap diabetes mellitus jenis 2. Kajian ini juga menunjukkan minyak kelapa sawit berupaya menurunkan paras gula dalam badan dan menambahbaik dislipidemia. Tahap stres oksidatif juga menurun dengan pengambilan minyak kelapa sawit. Oleh itu, penemuan ini menunjukkan potensi minyak kelapa sawit sebagai antidiabetik.

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I certify that an Examination Committee met on ……to conduct the final examination of Hanieh Jafari on her Master degree thesis entitled "Effects of lycopene and red palm oil on oxidative stress in streptozotocin-induced diabetic rats" in accordance with "Universiti Pertanian Malaysia" (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date: 22 February 2011

DECLARATION

I declare that the thesis is my original work except for quotations and citaions which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at other institutions.

HANIEH JAFARI

Date: 29 December 2010

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